

## CLAIMS:

1. An X-ray apparatus for high-resolution X-ray diffraction of thin layers of single crystal, comprising:

5 a sample stage (8) holding a sample (16) having a substantially single crystal thin layer (18) at a front face (12) with the front face (12) oriented substantially normally to a predetermined normal direction (14);

a means (4,6) for generating a collimated beam of X-rays (11) at a predetermined target location (15) on the sample stage at an angle of between  
10 0° and 60° to the normal direction, the beam having an angular divergence at the sample stage in the range 0.01° to 0.20°; and

an X-ray detector (10) arranged laterally of the sample stage for detecting X-rays scattered by the sample (16) to a predetermined range of angles to the normal direction (14), the angles in the predetermined range  
15 being in the range from 80° to 90°;

wherein the means for generating a collimated beam of X-rays comprises an X-ray source (4) and a slit (6) between the X-ray source and the sample stage.

20 2. An X-ray apparatus according to claim 1 wherein the means for generating a collimated beam does not include a monochromator.

3. An X-ray apparatus according to claim 1 or 2 wherein the X-ray detector (10) has a linear resolution in the normal direction (14) of less than  
25 0.002 times the distance from the X-ray detector to the predetermined target location.

4. X-ray apparatus according to claim 1, 2 or 3 wherein the X-ray source (3) has a dimension of no more than 0.2mm in the direction normal to  
30 the beam in the plane containing the normal, the incident beam and the scattered X-rays.

5. An X-ray apparatus according to any preceding claim wherein the X-ray detector (10) is an elongate X-ray detector extending in a direction parallel to the normal direction (14) for detecting in parallel X-rays diffracted by the sample as a function of distance along the normal direction and hence over a predetermined range of angles to the normal direction.

6. An X-ray apparatus according to any preceding claim wherein the position sensitive X-ray detector (10) is a solid state detector.

7. An X-ray apparatus according to any preceding claim wherein the substantially single crystal thin layer (18) is a semiconductor layer.

8. Use of an X-ray apparatus according to any preceding claim to measure the sample (16) the sample (16) being mounted on the sample stage (8) and oriented to diffract the collimated X-ray beam (11) onto the position sensitive X-ray detector (10).

9. A method of high-resolution X-ray diffraction; comprising:  
providing a sample stage and an X-ray detector located laterally of the sample stage;

mounting a sample having a substantially single crystal thin layer material extending in a plane on the sample stage;

directing an incident collimated beam of x-rays created without a monochromator onto the sample at an angle of  $0^\circ$  to  $60^\circ$  to the normal to the plane; and

measuring with the X-ray detector the X-rays diffracted by the sample to a range of angles in the range  $80^\circ$  to  $90^\circ$  to the normal to the plane.

10. A method according to claim 9 wherein the incident beam has an angular divergence in the range  $0.01^\circ$  to  $0.20^\circ$ .

11. A method according to claim 9 or 10 wherein the incident beam of X-rays is in a direction from  $0^\circ$  to  $40^\circ$  to the normal to the plane.

12. A method according to any of claims 9 to 11 wherein the step of  
5 measuring the X-rays diffracted by the sample (16) includes recording the intensity of X-rays incident on the detector (10) simultaneously at a number of locations along the length of the detector.